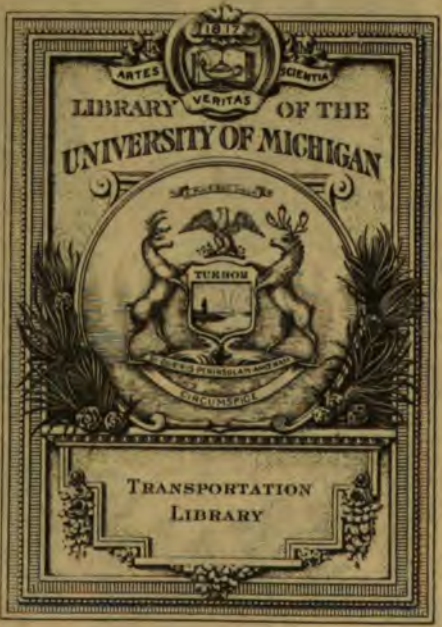
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OF CURRENT

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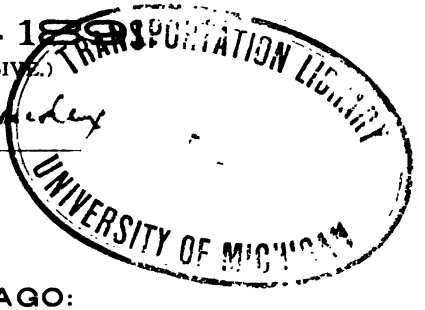
VOLUME I.

1884 - 1889

(INCLUSIVE.)

First volume of Engineering Index



CHICAGO:

Published by the Board of Managers of the

ASSOCIATION OF ENGINEERING SOCIETIES.

JOHN W. WESTON, Secretary,

51 LAKESIDE BUILDING.

Press of JOHN W. WESTON PRINTING HOUSE, Blue Island, Ill.

PREFACE.

The material composing this volume has appeared in the monthly numbers of the JOURNAL OF THE ASSOCIATION OF ENGINEERING SOCIETIES since October 1884, under the title of "*Index Notes.*" The notes published in the twelve numbers of one year have been republished, with cross-references, arranged in one alphabetical list, in an appendix to each volume. Seven of these annual summaries are now brought together, rearranged alphabetically, with numerous cross-references, and with a more systematic arrangement of subject matter. It is published by the Board of Managers of the JOURNAL and placed on sale at a price barely sufficient to pay the cost of arrangement and publication.

Although there are over eleven (11) thousand notes and cross-references in this list, no claim is made for its completeness, even for the period covered by it. It is thought to contain, however, nearly all periodical, society, and fragmentary matter of permanent value not only for the period 1884 to 1891, inclusive, but a great deal which appeared earlier. Thus the entire proceedings of the *American Society of Civil Engineers*, of the *American Society of Mechanical Engineers*, and of the *Association of Engineering Societies*, have been indexed so far as they seemed deserving. Also the complete files of *Van Nostrand's Engineering Magazine*, and of *The Engineering News*. The *Proceedings of the Institution of Civil*

Engineers are here indexed only for the period covered for the current literature, viz: 1884—1891 inclusive. A complete index of these proceedings is issued every few years by the Institution.

The object kept constantly in view in the preparation of these Index Notes was to put, in as small a space as possible, such short descriptions of the scope and general character of the current engineering literature of a periodical or fragmentary character as would enable one in search of valuable information on a particular subject to decide whether or not it would be worth his while to obtain or consult the original article, paper, or report. No abstracts, or results, or summaries have been made, and no conclusions given. In other words these notes only serve to indicate where valuable data can be obtained. It is mostly limited also to the fields of civil and mechanical engineering. That is to say, chemical and metallurgical subjects in mining engineering have not been indexed, while other subjects in this general field more closely related to the work of civil and mechanical engineers have been taken. Articles of a casual or passing interest, but of no permanent value have not often been indexed, and such matter as was thought to lead to erroneous conclusions or as were based on false assumptions or theories, have always been excluded.

Since its inception the preparation of these notes has been under the direct control of the undersigned, nearly all the notes for the first two years having been prepared by him. Since that time the work has been performed in succession by Mr. C. V. Mersereau (C. E., Cornell) M. Am. Soc. C. E., C. W. Melcher (M. E. Washington University.) M. Am. Soc. M. E., O. E. Hovey, (C. E., Thayer) Instructor in Civ. Eng., Washington University, and F. E. Turneaure (C. E., Cornell) Instructor in Civ. Eng., Washington University. Valuable assistance has also been rendered by Prof. Geo. F. Swain, M. Am. Soc. C. E. and by Mr. Clemens Herschel, M. Am. Soc., C. E. No simply clerical workers have ever been employed, and it is thought that the expression of opinion or of favor found in these notes may generally be relied on. The final preparation of this seven year summary for the press, its arrangement, classification, and the cross-references, has devolved upon Mr. Turneaure, who has been assisted by Mr. T. L. Condron C. E.

The value of a carefully prepared index such as is here offered can scarcely be overestimated. Even though the publications to which the references are made are not in one's private library, they generally are accessible and can be found in public or society libraries. On the other hand even though these volumes all stand on one's own shelves, if he does not know what they contain, or where to find an article which he dimly

remembers to have seen, the task of making the search is so great as to forbid the effort, and the volumes remain unconsulted. It is the writer's firm belief that an index, such as this, without a library is of more value to a student than the library if he has no index to its contents.

If the volume now put forth should be appreciated for what it contains rather than criticised for what it lacks, and if it should contribute somewhat to the cause of good engineering in America, those to whom its usefullness is due will feel fully repaid for what has been largely a labor of love.

J. B. JOHNSON,
Manager Index Department.

WASHINGTON UNIVERSITY, St. Louis, Apr. 15, 1892.

LIST OF PERIODICALS, ETC., INDEXED.

With General Abbreviations.

Age of Steel (*Age of Steel*), weekly, Equitable Building, St. Louis, Mo.

American Architect (*Am. Arch.*), weekly, Ticknor & Co., 211 Tremont Street, Boston, Mass.

American Engineer, (*Am. Eng.*)

American Journal of Railway Appliances (*Am. Jour. Ry. Appli.*), monthly, World Building, New York.

American Machinist (*Am. Mach.*), weekly, 96 Fulton street, New York.

American Manufacturer and Iron World (*Am. Mfr.*), weekly, Pittsburg, Pa.

Annales des Ponts et Chaussees (*Annales des P. & C.*), monthly, Vve. Ch. Dunod, 49 Quai des Augustins, Paris, France.

Annales des Travaux Publics, Paris, France.

Building, (*Building*), weekly, New York City.

Cassier's Magazine (*Cassier's Mag.*), New York City.

Centralblatt der Bauverwaltung.

Der Civil Ingenieur.

Deutsche Bauzeitung (*Deutsche Bauzeitung.*)

Electrical Review (*Elec. Rev.*), weekly, 22 Paternoster Row. London, England.

Engineering (Lon. *Eng.*), weekly, London, England.

Engineering and Mining Journal (*E. & M. Jour.*), weekly, 27 Park Place, New York.

Engineering News (*Eng. News*), weekly, Tribune Building, New York.

Engineering Record (*Eng. Rec.*), weekly, formerly The Sanitary Engineer, (*San. Eng.*), and the Engineering and Building Record (*Eng. & Build. Rec.*), 227 Pearl street, New York.

Fire and Water, (*Fire & Water*), New York City.

Illinois Society of Engineers and Surveyors, (*Rep. Ill. Soc. Eng. & Surv.*), Champaign, Ill.

Indian Engineering (*Ind. Eng.*), weekly, Calcutta, India.

Iron, (*Iron*), weekly, London, England.

Journal of the Association of Engineering Societies (*Jour. Assn. Eng. Soc.*), monthly, 51 Lakeside Building, Chicago.

Journal, Engineering Society, Lehigh University, (*Jour. Eng. Soc. Lehigh University*), Bethlehem, Pa.

Journal of the Franklin Institute (*Jour. Frank. Inst.*), monthly, Franklin Institute, Philadelphia, Pa.

Journal fur Gasbeleuchtung und Wasserversorgung, (*Jour. f. Gasbel. u. Wasserversorgung.*)

Journal of the New England Water Works Association (*Jour. N. E. W. W. Assn.*), quarterly, 113 Devonshire St., Boston, Mass.

Journal Royal Society of New South Wales (*Australia.*)

Journal of the Society of Arts (*Jour. Soc. Arts*), weekly, London, England.

Locomotive Engineering, (*Loc. Eng.*), monthly, 9–12 Temple Court, New York.

Manufacturer and Builder (*Mfr. & Build.*), monthly, New York City.

Mechanics (*Mechanics*), monthly, 907 Arch Street, Philadelphia, Pa.

Mining and Scientific Press. (*Min. & Sci. Press*), weekly, San Francisco, Cal.

Nouvelles de la Construction.

Popular Science Monthly, (*Pop. Sci. Monthly*), New York City.

Power (*Power*), monthly, 113 Liberty Street, New York.

Proceedings American Institute of Mining Engineers (*Proc. A. I. M. E.*), 13 Burling Slip, New York.

Proceedings, Cleveland Institute of Engineers, (*Proc. Cleveland Inst. Engrs.*), England.

Proceedings of the Engineers' Club of Philadelphia (*Proc. Eng. Club, Phila.*), quarterly, 1122 Girard St., Philadelphia, Pa.

Proceedings Indiana Association, Surveyors and Engineers, (*Proc. Ind. Assn. Surv. & Eng.*), Rensselaer, Ind.

Proceedings of the Institution of Civil Engineers (*Proc. Inst. C. E.*), 25 Great George St., Westminster, S. W., London, Eng.

Proceedings Master Car Builders' Association, (*Proc. M. C. B. Assn.*)

Proceedings Michigan Engineering Society (*Proc. Mich. Eng. Soc.*), Climax, Mich. Formerly Michigan Association of Surveyors (*Mich. Assn. Surv.*)

Proceedings, Nebraska Society of Associated Engineers and Surveyors, (*Proc. Neb. Assn. Eng. & Surr.*)

Proceedings of the Society of Arts (*Proc. Soc. Arts*), Mass. Institute of Technology, Boston, Mass.

Proceedings of Society of Civil Engineers, Paris, (*Proc. Soc. Civ. Eng., Paris*), Paris, France.

Proceedings of the United States Naval Institute (*Proc. U. S. N. I.*), quarterly, United States Naval Institute, Annapolis, Md.

Railroad and Engineering Journal (*R. R. & Eng. Jour.*), monthly, 45 Broadway, New York.

Railroad Gazette (*R. R. Gaz.*), weekly, 73 Broadway, New York.

Railway Review (*Ry. Rev.*), weekly, The Rookery, Chicago Ill.

Railway World, (*Ry. World.*), Philadelphia, Pa.

Reports of Chief of Engineers, U. S. A., Washington, D. C.

Reports of Ohio Society of Engineers, Columbus, Ohio.

Revue des Mines.

Sanitary News. (*San. News.*)

School of Mines Quarterly (*Sch. Mines. Quart.*), Columbia College, New York.

Science, (*Science*), monthly, New York City.

Scientific American (*Sci. Am.*), weekly, 361 Broadway, N. Y.

Scientific American Supplement (*Sci. Am. Sup.*), weekly 361 Broadway, New York.

Selected Papers, Rensselaer Society of Engineers, Troy, N. Y.

Stevens Indicator (*Stevens Indicator*), Stevens Institute of Technology, Hoboken, N. J.

Street Railway Journal (*St. Ry. Jour.*), monthly, World's Building, New York.

Street Railway Review (*St. Ry. Rev.*), monthly, 334 Dearborn st., Chicago, Ill.

Technology Quarterly (*Tech. Quart.*), Mass. Inst. Technology, Boston, Mass.

The Electrical Engineer (*Elec. Engr.*), monthly, 11 Wall Street, New York.

The Electrical World (*Elec. World*), weekly, 177 Times Building, New York.

The Electrician and Electrical Engineer, (*Electrician & Elec. Eng.*)

The Engineer (Lon. *Engineer*), weekly, London, England.

The Engineering Magazine (*Eng. Mag.*), monthly, World Building, New York.

The Iron Age (*Iron Age*,) weekly, New York City.

The Locomotive (*Locomotive*), monthly, Hartford, Conn.

The Mechanical World (*Mech. World*), weekly, Manchester, England.

The National Car and Locomotive Builder, (*Nat. Car & Loco. Build.*). monthly, New York City.

The Polytechnic, (*Polytechnic*), Troy, N. Y.

The Practical Engineer, (*Practical Engineer.*). London, England.

The Progressive Age (*Progressive Age*), Philadelphia, Pa.

The Railway Engineer (*Ry. Eng.*), monthly, 8 Catherine St., Strand, W. C., London, Eng.

The Railway Master Mechanic (*Mast. Mech.*), monthly, "The Rookery," Chicago Ill.

The Sanitarian, (*Sanitarian*), New York City.

The Technograph, (*University of Illinois Annual*), Champaign, Ill.

The Street Railway Gazette (*St. Ry. Gaz.*), monthly, 8 Lakeside Building, Chicago.

The Technic (*Technic*), University of Michigan, Ann Arbor, Mich.

The Transit (*Transit*), University of Iowa.

Transactions of the American Institute of Electrical Engineers, (*Trans. A. I. E. E.*), Temple Court, New York City.

Transactions American Society of Civil Engineers (*Trans. A. S. C. E.*), 127 East Twenty-third street, New York.

Transactions American Society of Mechanical Engineers (*Trans. A. S. M. E.*), 12 West 31st Street, New York.

Transactions Arkansas Society of Civil Engineers Architects and Surveyors, (*Trans. Ark. Soc. C. E., Arch. & Surv.*), Little Rock, Ark.

Transactions Canadian Society of Civil Engineers (*Tran. Can. Soc. C. E.*), Sec'y McGill University, Montreal, Canada.

Transactions Engineers Society of Western Pennsylvania, (*Trans. Eng. Soc. W. Penn.*) Pittsburgh, Pa.

Transactions Liverpool Engineering Society, (*Trans. Liverpool Eng. Soc.*), Liverpool, England.

Transactions of the Technical Society of the Pacific Coast (*Trans. Tech. Soc. Pac. C.*), Rooms 14-15, 408 California street, San Francisco, Cal.

Van Nostrand's Engineering Magazine (*Van Nos. Eng. Mag.*), New York City.

Van Nostrand's Science Series, (*Van Nos. Science Series.*), New York City.

Wochenschrift des Oesterreichischen Ingenieur und Architekten Vereins, (*weekly*), Vienna, Austria.

Zeitschrift des Architekten und Ingenieurs Vereins (*Zeitsch. des Arch. u. Ing. V.*) Hanover, Germany.

Zeitschrift fur Bauwesen, (*Zeitsch. Bauwesen.*)

Zeitschrift des Oesterreichischen Ingenieur und Architekten Vereins, (*Zeitsch. des. Oesterr. u Arch. V.*), Vienna, Austria.

Zeitschrift des Vereins Deutscher Ingenieur.

Zeitschrift fur Vermessungwesen, (*Zeitsch f. Vermessungwesen.*)

There are a number of other references which are not catalogued above, for the reason that they are self explanatory and not of such frequent occurrence.

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DESCRIPTIVE INDEX.

Addresses, continued.

Cooley, L. E., Retiring Address of President L. E. Cooley to the Western Society of Engineers, on "The Modern Spirit of the Engineering Profession." *Jour. Assn. Eng. Soc.*, Feb., 1891, pp. 63-8.

Corthell, E. L., on Retiring from Presidency of the Western Society of Engineers. Jour. Assn. Eng. Soc., May, 1890, pp. 209-233.

FitzGerald, Desmond, President Boston Soc. of C. E. Delivered March 20, 1889. *Jour. Assn. Eng. Soc.*, May, 1889, Vol. VIII., p. 251.

Flad, Henry. One Year of Engineering Progress. The annual address before the Denver meeting of the American Society of Civil Engineers. *Eng. News*, July 17, 1886.

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Jones, Washington. A review of the great projects of the year. By the retiring President of the Philadelphia Engineers' Club. *Proc. Eng. Club Phila.*, Vol. VI., p. 81.

Meier, E. D., on Retiring from the Presidency of the St. Louis Engineers' Club. Jour. Assn. Eng. Soc., Feb., 1890, Vol. IX., pp. 43-50.

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Preece, W. H., Pres., to the Mechanical Science Section of the British Association, Bath, 1888. Reviews the developments of the practical applications of electricity. *Engineer*, Sept. 7, 1888; *T. J. and Elec. Rev.*, Sept. 7, 1888; *Jour. Soc. Arts.*, Sept. 14, 1888; *Sci. Am. Sup.*, Sept. 29, 1888.

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Shunn, Wm. P., President A. S. C. E., at Cresson meeting. *Eng. News*, July 5, 1890, pp. 9-11.

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Worthen, Wm. E., Before Am. Soc. C. E. Gives resume of the work of engineers during the past year. *Eng. News*, July 9, 1887; *San. Eng.*, July 16, 1877.

Wright, A. W., to the Western Society of Engineers. Gives brief review of some of the principal engineering achievements of the year. *Jour. Assn. Eng. Soc.*, Vol. VI., p. 181.

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Aerial Navigation.

Extended discussion of the subject by Wm. Pole, F. R. S., in a paper before the *Inst. of Civ. Engrs.*, Vol. LXVII. Also, by same author, "Some Further Data on Aerial Navigation." *Am. Engr.*, Aug. 6, 1885. The former article is one of the most valuable that has ever appeared.

Flying Machine Memoranda. By L Hargrave. Figure of 8 wing movement, and engine. Screw driver flying machine. Three cylinder air engine, and flying model. Theory of air rollers. *Royal Society of New South Wales: Journal.* Vol. XXIII., pp. 70-74. 8 plates.

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Improvements in. By Prof. W. Le Conte Stevens. An historical article, giving the recent improvements made in France up to 1885. Illustrated. *Pop. Sci. Monthly*, July, 1885.

Aerial Navigation, continued.

Interesting illustrated lecture delivered by Mr. O. Chanute, C. E., at Cornell Univ. *R. R. & Eng. Jour.*, July, 1890, *et seq.*, pp. 316-8.

Mechanical Flight. A practical criticism of Prof. Langley's article in the *Century* Magazine, by Wm. H. Harrison. *Am. Mach.*, Oct. 1, 1891.

Mechanics of Flying. By Ludwig Kargl. Object is to investigate under what circumstances it is possible for a machine to raise itself into the atmosphere and at the same time guide its motion in any given direction *Van. Nos. Eng. Mag.*, Vol. IV., pp. 316-530.

Military Ballooning in France. An account of the most recent results attained. Illustrated. *Sci. Am. Sup.*, Nov. 6, 1886.

Power Required. By Hiram S. Maxim. Exolains the principle of the aeroplane and describes his apparatus for testing it, giving general results of tests. Illus. *Century Mag.*, Oct., 1891, pp. 829-36.

Present State of, giving most modern devices, with mathematical discussion of principles, by M. DeBruignac. *Proceedings of Society of Civil Engineers*, Paris, October, 1884.

Problem of Air Navigation. A popular article by Prof. R. H. Thurston, discussing the history of the problem and experiments and observations upon birds. *The Forum*, Vol. VIII., pp. 542-54.

Progress in. A review by O. Chanute. Illus. *Eng. Mag.*, Oct. 1891, pp. 1-13.

Progress in, (continued). Article by Mr. O. Chanute containing illustrations of various flying machines from 1500 to 1879. *R. R. & Eng. Jour.*, Nov. 1891.

Prospects of Successful. Extract from letter in *New York Times*, by Hiram S. Maxim, stating how he is at present working on this problem. *R. R. & Eng. Jour.*, January, 1891.

Short sketch of its history and a description of a new form of motor for an air ship. *Am. Eng.*, May 22, 1885.

Vacuum vs. Inflation. A paper by Dr. A. de Bausset, Boston, Mass. *Am. Engr.*, Nov. 29, 1890, pp. 238-9. *et seq.*

Aerodynamics, *Experiments in.* By Prof. S. P. Langley, being experimental demonstrations of certain propositions in aerodynamics which prove that "flying" under proper direction is practicable. Very extensive experiments with "planes," Detailed description, results, etc. No. 801, Vol. XXVII., *Smithsonian Series*, 1891, pp. 115, pls. X.

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Flow of, through Orifices in a Thin Plate. By A. Fliegner. Gives formula derived from experiments made with orifices from 3.17 to 11.36 millimeters in diameter. *Van. Nos. Eng. Mag.*, Vol. XXV., p. 217.

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In Large Towns. A paper by William Thomson on the injurious effect of the air in large towns on animal and vegetable life, and the methods of securing a salubrious air. *Van. Nos., Eng. Mag.*, Vol. XX., p. 488.

Test of its Purity as to Carbonic Acid. A simple and exact quantitative test that may be applied by any one to test the fitness of air for breathing. *Abs. Proc. Inst. C. E.*, Vol. LXXXI., p. 384.

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Aluminum, continued.

on cast-iron. Good results were obtained by its use. *Sci. Am. Sup.*, Sept. 8, 1888.

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Aluminum and its Alloys, in the Electric Furnace. A lecture before the Franklin Institute describing the methods used by the Cowles Electric Smelting and Aluminium Company at Cleveland, O. Illustrated. *Jour. Frank. Inst.*, Feb. 1886. Description of the same. *Engineer*, July 9, 1886.

Electricity in the Production of Aluminum. Abstract of a paper by Alexander S. Brown read before the Am. Inst. E. E., giving a history and description of the various processes employed. *Elec. Eng.*, Apr. 29, 1891, pp. 500 2. *Elec. World*, May 2, 1891, pp. 326-8.

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Heroult Process. Full description with illustrations of the plant used. *E. & M. Jour.*, Dec. 1, 1888; *Am. Mfr. and Iron World*, Nov. 23, 1888

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Its Production by the Hall Process. A new electrolytic process by which aluminum is produced continuously, directly from alumina, at a single operation. *Elec. World*, Sept. 21, 1889.

Lecture delivered before the Franklin Institute by Hanford Henderson, Professor of Chemistry and Physics, Philadelphia Manual Training School. An interesting account of the various processes used to obtain metallic aluminum. *Sci. Am. Sup.*, Jan. 5. 1889.

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Production of, with Special Reference to the Electrical Method. By Dr. Vander Weyde, before the Am. Inst. *Elec. World*, Jan. 15, 1887.

Production of the Alloys of Aluminum and Silicon in the Electric Furnace. (Cowles' process). A paper before Sec. B. British Association, by J. H. J. Dagger, F. C. S., F. Q. C., tracing the development of the industry from its inception, and giving concise descriptions of the new Cowles furnace and its operation; also giving a statement of the principal properties of aluminum alloys, as strength, elasticity, elongation, etc. *Sci. Am. Sup.*, Nov. 30, 1889.

Recent Development of the Cowles Process. By R. E. Crompton, before the Bath meeting of the British Association. Gives a description of the new plant for the production of aluminum at Milton, Eng. *T. J. and Elec. Review*, Sept, 14. 1888.

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Anemometers, continued.

"Annuaire Meteorologue" of the Danish Meteorological Institute, Copenhagen, 1877. *Journal of the Franklin Institute*, Sept., 1887, Vol. CXXIV., No. 741.

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Anchoring Bolts. See *Cements, Adhesive Strength.*

Angle Bars. See *Railroad Track.*

Angle Irons. *Drifting Test for Steel Angle Bars.* Illustrated article. *Eng. News*, April 27, 1889.

Tests of Full Sized Angle Irons. Abstract of a paper by Charles F. Loweth, M. Am. Soc. C. E., and given in *Jour. Assn. Eng Soc.*, May, 1889, *q. v.*, *Eng. & Build. Rec.*, Feb. 1, 1890, Vol. XXI., p. 133.

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Conestoga Replacing the. Gives method employed to shift the old bridge on to the temporary trestles. Cuts show details of trestle pier. *Eng. News*, Oct 22, 1887.

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Deflection. See *Bridge Stress and Deflection.*

Designing of. See *Bridge Designing.*

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Developement of. See *Bridge History.*

Draw. See *Bridges. Draw* below.

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Economy in. See *Bridges, Long Span.*

Over the Elbe at Hamburg and at Harburg. Built 1869-72. Spans of about 325 feet of "fish-belly" form, built of wrought iron; the upper chord consists in itself of two chords and panel bracing, as does likewise the lower chord, and the

Bridges, continued.

two are connected by vertical suspension rods only, these suspension rods holding up the track construction. The constructive analysis of the bridge makes it an arched bridge, with parallel chords and panel bracing, supported on towers erected on the piers, the height of the towers equal to the deflection of the stiffened suspension bridge structure (above spoken of as the lower chord of the "fish-belly" bridge), and whose sole office is to neutral ze the thrust of the arch. The bridge platform, or track construction, is tangent to this double lower chord, and is supported from the arch by suspension members. A comparison of the weight of this bridge with others of like span and strain on the materials of construction, shows it to be a favorable form of bridge-truss, as far as own weights are concerned. *Zeitschrift f. Bauwesen.*. 1885, pp. 75-178.

Erection of. See *Bridge Erection*.

Failures. See *Bridge Accidents.*

Fall River. Description of the building of the cast iron cylinder piers. By E. N. Winslow. *Eng. News*, April 9, 1881, pp. 146-7.

Floors of. See *Bridge Floors*.

Foot. River Ouse, Bedford, Eng. Gives plan, elevation and cross-section of a foot-bridge of 100 ft. span, practically without abutment. *Sci. Am. Sup.*, Sept. 8, 1888.

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Forth. See *Bridges, Cantilever.*

Girders. See *Bridges Girders* below.

Guard Gates. Description of Guard gates at Point street bridge at Providence, R. I. Paper by Wm. D. Bullock, M. Am. Soc. C. E., giving description and complete illustrations of gates and operating machinery. *Trans. A. S. C. E.*, Feb., 1889, Vol. XX., p. 78.

Guard Rails on. See *Bridge Guards*

Hannibal. Gives description of the combined highway and railroad bridge across the Mississippi River at Hannibal, Mo. *Van Nos. Eng. Mag.*, Vol. V., p. 306.

Hawkesbury, Australia. Drawings of the fourteen competitive designs, three American, ten English and one French, with the corresponding bids. All the American bids, being far below the others, the reward was made to the Union Bridge Co. Lon. *Eng.*, *Eng. News*, May 8, 1886: *R. R. Gaz.*, April 30, 1886; also *Ry. Rev.*, May. 8, 1886. Small map and elevation; showing depth of foundation and details of caissons given. These to be sunk to a depth of 185 feet below high water. Proposed method described. *Eng. News*, Feb. 13, 1886. Method to be employed in sinking piers to the depth of 185 feet. *Ry. Rev.*, May 15, 1886.

A two-page plate showing general design and details. Lon. *Eng.*, Feb. 25, 1887.

A description of the above bridge, with plates showing strain sheet, method of loading and various details. Lon. *Eng.*, April 8-22, 1887.

Hawkesbury, New South Wales. Illustrations and description of the method of erecting on pontoons and floating to place. *R. R. Gaz.*, Aug. 10, 1888; *Indian Engineer*, July 28, 1888; *Sci. Am. Sup.*, Aug. 11, 1888; Lon. *Eng.*, Sept. 7, 1888.

Motions, Observed in. An article by W. Ewald, Hamburg, advancing the idea that the material immediately surrounding the piers and underneath them is mud which would present but slight resistance to lateral motion. Lon. *Eng.*, Feb. 6, 1891. Reprinted in *Eng. News*, March 14, 1891, pp. 247-8.

Bridges, continued.

Highway. See *Bridges, Highway*, below.

History of. See *Bridge History*.

Howe Trusses.

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Oregon Pacific Ry. An article giving short description and details as well as complete strain sheets of Howe Truss Bridges on above road for spans of 30 to 150 feet. *Eng. News*, April 26, 1890, Vol. XXIII., p. 402.

Willamette River, Oregon. Gives elevation, cross section and details of a timber Howe truss across the Willamette River, Oregon. It has two spans 175 feet long, and a draw span 260 feet in length. Lon. *Eng*., Jan. 6, 1888; *Sci. Am. Sup*., March 17, 1887.

See *Bridge Designing, Arching, etc. Howe Truss*.

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Long Span. The economic conditions of long-span bridges, with special reference to the proposed North River Bridge at New York City. Address before Am. Assn. for the Advancement of Science (No. 1) at Toronto meeting, by Gustav Lindenthal, C. E. *Eng. News*, Nov. 9, 1889, Vol. XXII., p. 436.

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Pontoon Railway Bridge across the Miss. Riv. at Prairie du Chien. Description, with plates and discussion. *Trans. A. S. C. E.*, Vol. XIII., p. 67.

Pony Lattice, W. S. R. R. Gives plan, elevation and cross-section, with dimensions of a pony lattice bridge truss built at Normanskill, N. Y., on the West Shore Railroad. Span, 86 ft.; clear width, 14 ft.; height, 10 ft., and weight, 50 tons. *R. R. Gaz.*, Sept. 21. 1888.

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Van Buren, Ark.

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See *Arches. Bridge Stresses.*

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Machinery at. By Wm. Arrol, before the Institution of Mechanical Engineers. Gives description of the machinery employed in the erection of the Forth bridge. Illustrated. Lon. *Eng.*, Sept. 9, 1887.

Observations on. A paper read by Dr. Charles E. Emery. Elevation and sections. Tables of temperature and diagrams showing temperature movements. *Trans. A. S. C. E.*, Vol. XXII., June, 1890, pp. 409-24.

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Popular article describing several interesting features and giving a table of existing cantilever bridges. By Thos. C. Clarke, *Eng. Mag.*, Apr., 1891, Vol. I., No. 1, pp. 65-79.

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Raising one of caissons which accidently sank out of position. Described and illustrated. Lon. *Eng.*, Oct. 30, 1885.

Sixteenth quarterly report of progress made to the Board of Trade. *Am. Eng.*, May 18, 1887, also Lon. *Eng.*, April 15, 1887.

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Kanawha River Bridge. Very complete details of this cantilever bridge. *Eng. & Build. Rec.*, Aug. 17, 1889, Vol. XX., p. 161, *et seq.*

Kentucky River or Tyrone Cantilever Bridge, on the Lexington extension of Louisville Southern Ry., built by Union Bridge Co. A general description is given with several illustrations, including details of adjusting machinery, and an inset plate giving complete strain sheets and detail drawings of structure, including method of anchoring shore arm of cantilevers. *Eng. News*, April 5, 1890. Vol. XXIII., p. 319.

Kentucky and Indiana. By Mace Moulton. A paper before the American Society of Civil Engineers, containing a full account of the construction, with extracts from specifications, tables showing tests of materials, etc., of the bridge over the Ohio river at Louisville. Plates show design, locations, strain sheet and details. *Trans. A. S. C. E.* Vol. XVII., September, 1887, pp. 111-168; abstract in Lon. *Eng.*, Jan. 27, 1887.

Lachine.

Gives description with a two-page plate, with details of the bridge across the St. Lawrence River. Lon. *Eng.*, April 13, 1888.

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List of, See Bridges, Cantilevers, Forth.

Long Island, Proposed. A description of the proposed bridge between New York and Long Island, over Blackwell's Island. To consist of two cantilever bridges of 810 feet in the clear, resting on braced steel piers 110 ft. high. General elevation and some details in *Eng. News*, April 23, 1887.

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Market Street Bridge, Philadelphia. A deck-cantilever highway bridge, 77 ft. wide and 528 ft. long. Plans, elevations and details. *Eng. News*, Oct. 16, 1886

Niagara River. By C. C. Schneider, the engineer of the bridge. A most satis

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A paper by C. F. Findlay, M. A., A. M. Inst. C. E. This paper gives when taken with discussion thereon, a valuable treatment of cantilever bridges. *Trans. Can. Soc. C. E.*, Vol. III., pp. 54-110, 1889.

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By Thomas C. Clarke. The Second Sibley College lecture describing the erection of bridge over the Hudson at Poughkeepsie. *Sci. Am. Sup.*, May 19, 1888.

For an historical sketch of the project, general dimensions, description, etc., as well as many fine illustrations of the bridge and its vicinity, see *Poughkeepsie Daily Eagle*, Souvenir Edition, 1889: also *E. & M. Jour.*, Feb. 2, 1889.

Foundation and Substructure of the Poughkeepsie. Gives description of the methods used for founding the pier, and some details of the difficulties met and overcome. Illustrated. *Eng. News*, Oct. 29, 1887; see also Lon. *Eng.*, Aug. 26, 1887, and *R. R. Gaz.*, July 1, 1887.

Quebec. Proposed Cantilever over the St. Lawrence. Illustrated. *Am. Eng.*, May 1, 1885.

Red Rock, Col.

A description of the foundations and superstructure of the largest cantilever bridge in the U. S. A valuable folding inset shows the details. *Eng. News*, Sept. 27 and Oct. 4, 1890, pp. 274, 303-5.

An account of this bridge now under construction across the Colorado River, including outline profile, details of caissons and inset sheet of photo-reproduction. *R. R. Gaz.*, April 25, 1890, Vol. XXII., p. 278.

St. John's River, New Brunswick. Central Span 447 feet. Full description and cuts showing stages in erection. *R. R. Gaz.*, Oct. 30, 1885. Also Lon. *Eng.*, Aug. 6, 1886, *et seq.*

Sukkur, India.

Span, 820 feet. Several new features. Cut given. From *Mech. World*, London: in *Ry. Rev.*, Dec. 12, 1885; also Lon. *Engineer*, July 9, 1886.

Brief description with three full-page illustrations. Lon. *Eng.*, Jan. 4, 1889.

Illustrated article showing the various proposed crossings of the Indus, and a general view of the bridge. *Ind. Eng.*, April 22, 1889.

By Wm. Parsey. Gives a description of staging and temporary erection of the Sukkur cantilever bridge at the bridge works. A two-page plate gives details of staging, etc. Lon. *Eng.*, March 2, 1888.

A brief description, with large colored plate, of the staging for the main pillars and guys of the 820-foot cantilever span. *Ind. Eng.*, Nov. 5, 1887.

A paper by F. E. Robertson, before the Inst. C. E., describing the erection. Abstract with elevation and plan of superstructure; *Ry. Rev.*, Apr. 11, 1891, pp. 230-1.

Theory of Cantilever Bridges. Notes on. A paper by Charles McMillan, C. E., Professor of Civil Engineering at Princeton College. Methods of computing stresses, both analytically and graphically, are given. Illustrated by two plates. *Selected Papers of Rensselaer Soc. of Engrs.*, Vol. II., No. 2, p. 63, June, 1889.

See *Bridges, Long Span.*

Bridges, Draw.

Arthur Kill. Gives a brief description, with plan and details of the drawbridge recently constructed between Staten Island and New Jersey. Total length of draw, 496½ feet; clear water-way 206+204 feet. *R. R. Gaz*, June 22, 1888.

Bridges, Draw, continued.

By Clemens Herschel. Treats on the principles of construction of and the calculation of the strains in revolving drawbridges having two spans as openings and built as continuous girders, more especially as continuous panel girders. *Trans. A. S. C. E.*, Vol. III., (1874), pp. 395-448.

Carrying a Cable R. R. Across. See *Cable Railroads.*

Clarence Bridge at Cardiff. A steel structure 464 ft. long with a 190 ft. draw span. Details of superstructure, caissons, and fenders are given with a general description of the bridge. Lon. *Eng.*, Feb. 13, 1891, pp. 185-8, *et seq.*

Coteau.

The Swing Span and Pivot Pier of the Coteau Bridge; Method of Floating Spans into Place. Illustrated description with inset showing details of machinery for operating. *Eng. News*, May 30, 1891, pp. 524-5.

An illustrated description of the process used in sinking the foundations of this Canadian bridge over the St. Lawrence. Open caissons filled with concrete were used. *Eng. News*, April 12, 1890, Vol. XXIII., p. 338.

Electric Motor for Drawbridges. Illustrated description of the new electric turning gear of a drawbridge at Bridgeport, Conn. *St. Ry. Jour.*, May, 1889, Vol. V., p. 119.

Erection of a, without false works. By C. S. Maurice. Describes the erection of a pivot-span 260 feet long over the Tombigbee River, near Demopolis, Ala. *Trans. A. S. C. E.*, Vol. II., p. 330.

Florence Draw Bridge. 412 ft. span with both railroad and wagon roadways. Has special hand turning gear. Details of bridge and turning gear illustrated. *Eng. Rec.*, Feb. 28, 1891, pp. 208-12.

Folding-Floor Drawbridge. A novel type of drawbridge recently completed at Chicago, Ill. Brief description with illustrations. *Eng. News*, May 23, 1891, pp. 486-7.

Glamorganshire Canal Bridge. Fully illustrated description of a highway swing bridge. Entire weight rests on the pivot. Designed by Max am Ende. Lon. *Engineer*, Aug 7, 1891, pp. 105-7.

Hackensack Draw. Gives description of new draw-bridge recently built by the Erie Railroad over the Hackensack River, with drawings showing details of girders, turn-table, wedges and foundations of draw span. *R. R. Gaz.*, July 20, 1888.

Harlem River. A brief description of the draw-bridge over the Harlem River, with illustrations of details. Lon. *Eng.*, April 1, 1887.

Harlem River, New York. Designed by Theo. Cooper. Operated by hydraulic pressure. Illustrated and described in *Sci. Am.*, Jan. 2, 1886.

Hydraulic Swing. By W. E. Armstrong. Describes the Armstrong Swing Bridge over the Ouse. *Van Nos. Eng. Mag.*, Vol. I., p. 983.

Lifting, Tarante, Italy. Description of a bridge at Tarante, Italy, with plates showing details. It consists of two half arcs meeting in the center when closed; each half has a rising and rotating movement, and is worked by hand or turbines. Distance between axes of rotation, 220 feet Lon. *Eng.*, Oct. 28, 1887, *et seq.* Brief description, illustrated. *Sci. Am. Sup.*, Jan. 14, 1888.

Lifting, Utica, N. Y. By Squire Whipple. Gives description, with elevation and cross-section, of a "lift-draw-bridge" over the Erie Canal at Utica, N. Y. *Trans. A. S. C. E.*, Vol. III., pp. 190-4.

Masnedsund. Description of the swing bridge over the Masnedsund, between the Isle of Falster and Seeland, Denmark, with plan, elevation and some of the more important details. Lon. *Engineer*, March 4, 1887.

Milwaukee. Description of a 203-foot span double-track draw-bridge at Milwaukee. Cut showing details. *San. Engr.*, Nov. 26, 1887.

Milwaukee. Specifications for Draw-Bridge over Canal, for the C. M. & St. P.

Bridges, Draw, continued.

Ry. General specification for superstructure. *Eng. News*, Jan. 18, 1879, pp. 21-3.

Newark Bay Draw-bridge. Gives illustrated description of the old draw-bridge on the New Jersey Central road now being replaced by a new bridge. Also shows the construction of the temporary drawbridge now in use. *R. R. Gaz.*, June 17, 1887.

Pamunkey. The erection of the Pamunkey River Drawbridge, a 150 ft. span is described and fully illustrated in *Eng. Rec.*, Feb. 14, 1891, pp. 176-7.

Petaluma Draw. Gives brief description, with general view and plan and elevation of the central pier of the Petaluma drawbridge on the San Francisco & North Pacific Railroad. *Eng. News*, Oct. 13, 1888.

Rolling bridge over the —— lock in the harbor of Antwerp. *Wochenschrift des Oest. Ing.-u. Arch.-V.*, 1886, pp. 37-9.

Swinging Drawbridges by Electricity. Brief article describing arrangement of motor and gearing of a Chicago drawbridge. *R. R. Gaz.*, Aug. 21, 1891, p. 578.

St. Mary's Falls Canal Bridge and Dam. An illustrated description of this draw span, with attached movable dam. Includes illustrations of principal details and complete strain sheet. *Eng. & Build. Rec.*, March 22, 1890, Vol. XXI., p. 246.

Thames River Bridge. Complete general description. Abstract from the report of Alfred P. Boller, Chief Eng., *Eng. & Build. Rec.*, Oct. 11, 1890, pp. 295-7. Details of floor beams, pedestals and piers, *ibid*, Oct. 18, 1890, pp. 310-11. Drawings of turn-table, rail-lifts and locks, *Ry. Rev.*, Oct. 25, 1890, pp. 634-5. Piers and superstructure, *id.*, Nov. 29, 1890, pp. 713-15. Foundations, *R. R. Gaz.*, Nov. 7, 1890, pp. 763-4.

Tower Bridge. London. A series of illustrations of various details of this new and interesting structure, foundations and superstructure. Lon. *Engineer*, Vol. LXVIII., pp. 138, 140, 179, 202, 329, 336, 386, etc., 1889.

Tower Bridge at London. Short general description with illustration. A novelty in draw bridges. *R. R. & Eng. Jour.*, Oct., 1890.

Wells Street, Chicago, Removal of. Gives details of the moving of the Wells street draw-bridge, bodily, to its new position on Dearborn street. *Eng. & Build. Rec.*, April 14, 1888.

And their Turn-Tables. By C. Shaler Smith. A paper for "non-specialists," showing method of computing the strains; also, gives table of draw-bridge tests to obtain co-efficient of rolling friction. *Trans. A. S. C. E.*, Vol. III., pp. 129-41.

Willamette River. Bridges of the Oregon Railway & Navigation Co., over the Willamette River at Portland, Oregon, with illustrations of "Draw" in detail. *R. R. Gaz.*, April 19, 1889.

Winona Bridge. Brief description of the entire structure, with details of trusses, turning and lifting machinery of the swing span, illustrated. Specifications as to quality of steel also given. *Eng. News*, Oct. 17, 1891, p. 370.

See *Bridges, Arches, Tower.*

Bridges, Girders.

Bengal-Nagpur Railway Bridges. Specification for triangulated girder bridges, with insert, giving complete details. *Ind. Eng.*, May 18, 1889.

Continuous.

Application of the Theory of, to Economy in Bridge Building. By Chas. Bender. Reviews at length the many objections to the use of continuous girders, derives working formula, and compares weights with those of equal discontinuous spans. Illustrated. *Trans. A. S. C. E.*, Vol. V. (1876), pp. 147-198.

Bridges, Girders, continued.

Calculation of Contnuous Girders, analytically and graphically. By M. Bertrand de Fontviolant. A lengthy paper, containing a tolerably full discussion of the subject, including, besides the well-known theories, some investigations regarding effect of deformation of piers, and temperature. The paper, however, contains little, especially in the graphical treatment, which has not been given in previous discussions of the subject. *Memoires de la Soc. des Ing. Civ.*, Sept., 1885, pp 255-348, with 2 plates.

Discussion of continuous girders, with examples, by Mr. M. S. Hodgins. *Van Nos. Eng. Mag.*, Vol. XIX., p. 553.

International across the River Minho (Spain and Portugal). Detailed description of foundations and superstructure, lattice continuous girder, 5 spans, 61.5 to 69 meters, progress of the work, tests of materials, etc. *Revista de Obras Publicas*, 1886, January to June.

Paper by Chas. Bender on the application of the theory of continuous girders to economy in bridge building, with discussion. *Trans. A. S. C. E.*, Vol. V., p. 146.

Stress produced in continuous girders during launching. Said to be the first published solution of the problem. Illustrated. Lon. *Eng.*, Nov. 27, 1885.

Theory and Construction of. By Mansfield Merriman. The object of the paper is to present some of the main principles and laws and to illustrate this application to the practical designing of continuous bridge. *Van Nos. Eng. Mag.*, Vol. XV, pp. 145 and 193. Also *Van Nos. Sci. Series*, Vol. XXV. A criticism on the above by Chas. Bender. *Van Nos. Eng. Mag.*, Vol. XV., p. 289.

Variable Moment of Inertia. Moment and Load Coefficient. Graphical method. Illus. By C. H. Lindenberger. *Jour. Frank. Inst.*, Jan., 1891.

Chenab, India. Gives two pages of detailed drawings and abstracts from the specifications of the Chenab bridge, India state railroads. It is composed of 17 spans, of 206 feet each, of riveted triangular girder, Lon. *Engineer*, Sept. 14, 1888.

Dalmarnock Bridge. Fully illustrated description of this plate girder bridge at Glasgow. Details of piers are given. Lon. *Eng.*, March 28, 1890, p. 385.

Flanges. The Lateral Stability of. Theoretical discussion including the relation of wave length to stability. By Max am Ende. Lon. *Engineer*, May 29, 1891, pp. 419-20.

Formulas for the Weight of Girder. By Max am Ende. A discussion of the various formulas. *Proc. Inst. C. E.*, Vol. LXXXVII., p. 386.

Lattice Girder Overhead Crossing, Chicago, Santa Fe & California Ry. Paper by W. H. Breithaupt, read before the Engineers' Club of Kansas City, June 18, 1888. *Jour. Assn. Eng. Soc.*, Jan. 1889.

Napier Bridge Madras. An old lattice girder of ten 50 ft. spans on screw piles. Illustrated description. *Ind. Eng.*, May 2, 1891, p. 352.

On some Points for the Consideration of English Engineers, with reference to the Design of Girder Bridges. A paper before the Br. Assoc. Adv. Sc. Opposes the Board of Trade Rules and favors the American practice. Lon. *Engineer*, Sept. 10, 1886. Also *Eng. News*, Oct. 30, 1886.

Plate.

Highway Bridge; Brookline, Mass. Sections of abutments and wing-walls, with inset of details of girders. Owing to lack of head room the water pipe is carried through the triangular openings in the floor beams. *Eng. News*, Sept. 19, 1891, pp. 257-8.

Paper with formulas, plates and practical suggestions, by M. J. Becker, Chief Engr., P., C. & St. L. Ry. *Report Ohio Soc Surv.*, 1885.

Web. Thickness of. By J. J. Webster. A sensible discussion of the subject. *Trans. Liverpool Eng. Soc.*, Vol. III., p. 49.

Bridges, Girders, *Plate*, continued.

Pin Bearing Plate Girder Railroad Bridge. A 3-span girder, lower flange continuous, pin bearings, one end of the bridge being fixed and the other bearings on rockers. Illus. description. *Eng. Rec.*, Nov. 21, 1891, p 399.

See *Aqueduct, Plate Girder*.

Riveted. The Designing of, with investigation as to distribution of web stress and discussion on reamed rivet holes. By A. F. Hill. *Eng. News.*, Apr. 8 1888, p. 109.

Types of Iron Girder, Indian Midland R. R. A series of plates giving elevations, plans and details of types of iron girder in use on the Indian Midland R. R., India. *Ind. Eng.*, Aug. 25, *et seq.*, 1888.

Bridges, Highway.

Building of. By J. O. Wright. Discusses the present practice of building highway bridges and gives hints for improvements. *Rpt. Ill. Soc. Eng. & Surv.*, 1888, pp. 60-65.

Highway Bridges, Construction, Maintenance and Repair. By S. A. Buchanan. A very valuable paper, which points a way to the solution of the highway bridge problem. Supervision by a local engineer, with detailed plans and specifications, aided by a superintendent of repairs. A rational and efficient scheme which has been in successful operation for many years. *An. Rpt. of Ohio Soc. Eng. & Surv. for* 1888. C. N. Brown, Secretary, Columbus, O.

Design of. By M. J. Butler. Attempts a practical treatment, and endeavors to make plain some of the principles of design. *Proc. Prov. Land. Sur. of Ontario for* 1887.

By James Owen. A paper of much value to the young engineer, since the practical results from an experience with some 500 bridges of all sizes is given in the paper. Illustrated. *Trans. A. S. C. E.*, Vol. XI. (1882), p. 277.

Improved. By J. H. Burnham. Discusses the improvements made in highway bridges. The discussion on the paper relates mostly to the use of brick in place of stone. *Rpt. Ill. Soc. Eng. & Surv.*, 1888, pp. 47-54.

Iron Viaducts for Highways. A valuable paper by J. A. L. Waddell, C. E., of Kansas City, Mo. *Published in pamhplet form*, by Selden G. Spencer, Kansas City, Mo., June 1889.

Nova Scotia. By M. Murphy. Illustrated article, *R. R. Gaz.*, May 3, 1888.

Old Wooden Highway at Waterford, N. Y. A typical Burr truss span, 200 feet built in 1801, and still in use. Fully illustrated. *Eng. News*, June 1, 1889.

Overhead, N. Y. C. & H. R. R. Gives details of the 60-ft. span overhead highway bridge erected in New York City. *R. R. Gaz.*, Nov. 9, 1888.

Short Span. By S. A. Buchanan. Discusses the construction, maintenance and repairs of short span highway bridges. *Rpt. Ohio Soc. Eng. & Surv.*, 1888, pp. 184-194.

Supervision for New York. Proposed system of supervision. Paper by Chas. F. Stowell, M. Am. Soc. C. E. *Eng. News*, March 22, 1890, Vol. XXIII., p. 269, *et seq.*

Types. Drawing, with dimensions of two types of highway bridges, built by the N. Y., N. H. & H. R. R. *R. R. Gaz.*, Oct. 28, 1887.

See *Bridge Designing. Bridges, Draw.*

Bridges, Railroad.

Bridges and Culverts. Detailed drawing of a number of bridges and culverts recently constructed on the Eastern and Midland R. R., England. Lon. *Eng.*, Jan. 14 and 21, 1887.

Iron. A description of those recently erected on a new English road, which may be taken as modern English practice. Two plates. *Proc. Inst. C. E.*, Vol. LXXXII., p. 348.

Bridges, Railroad, continued.

Recent Construction of. A paper by James Ritchie. Includes a table of weights per foot of actual bridges of various spans. *Jour. Assn. Eng. Soc.*, Nov., 1890, pp. 511-17.

See *Bridge Floors.*

Bridges, Suspension.

By C. Bender. Traces the successive improvements in their mode of construction. *Trans. A. S. C. E.*, also *Van Nos. Eng. Mag.*, Vol. IV., p. 594.

Of Any Degree of Stiffness. By C. B. Bender. Gives the theory of equilibrium of a loaded elastic beam suspended from an elastic parabolic catenary. *Van Nos. Eng. Mag.*, Vol. XXV., p. 399.

Brooklyn Bridge.

Chatham Street Extension of the New York and Brooklyn. A description, with plan, elevation and details, of the New York and Brooklyn Bridge. *R. R. Gaz.*, May 13, 1887.

Enlarging the Capacity of the. Gives the report of the Board of Experts on the plans for enlarging the capacity of the Brooklyn bridge; also the report submitted to the Board by Mr. A. M. Wellington. *Eng. News*, March 17. 1888.

Foundations of. A paper before the Am. Soc. of C. E., by F. Collingwood, giving notes on the caissons of the East River Bridge. *Trans. A. S. C. E.*, paper, No. XXX., also *Van Nos. Eng. Mag.*, Vol. VII., p. 399.

Masonry of. By F. Collingwood. A valuable paper, giving details of the masonry work on the towers and anchorages of the East River Bridge. *Trans. A. S. C. E.*, Vol. VI., p. 7.

Progress of Work at, June, 1879. By F. Collingwood. Gives numerous details of methods used. *Trans. A. S. C. E.*, Vol. IX. (1880), pp. 162-172.

Railroad on. See *Cable Railroads.*

Report of the committee on Terminal Facilities, and the adopted plans for the terminals. *Eng. News*, April 21, *et seq.*, 1888; *R. R. Gaz.*, April 27, 1888; *Eng. & Build. Rec.*, Apr. 21, 1888.

Second annual report of the Chief Engineer of the New York Bridge Co. *Van Nos. Eng. Mag.*, Vol. V., p. 381.

A series of articles compiled from official reports and observation taking up the description of this work from the beginning in 1867. *Eng. News*, Apr. 30, Dec. 17, 1881.

Grand Avenue Bridge, St. Louis, Mo. General view and brief description of this handsome suspension bridge. *Eng. News*, June 27, 1891, pp. 610-11. Details of trusses, floor system, and anchorages, *ibid.*, July 18, 1891. General description and detail drawings are also given in *Eng. Record*, June 6, *et seq.*

Hammersmith. A two-page plate showing plan and elevation; also cuts showing details of towers, chain saddles and anchorages. Lon. *Engineer*, April 22 and 29, 1887. Details of construction of towers and roadway suspension connectors, also details of pier foundations, chains and anchorage. Lon. *Engineer*, May 20, 1887.

Iron Suspension Bridge at Harpers Ferry. Illus. *C. E. & Arch. Jour.*, 1857, p. 156.

Minneapolis Suspension. By T. M. Griffith. Gives brief description of the old and new bridges. *Van Nos. Eng. Mag.*, Vol. XVIII., p. 248.

Minneapolis. A paper by F. W. Cappelen, read before the Engrs. Club, Minneapolis, describing in detail this early structure. *Jour. Assn. Eng. Soc.*, Aug., 1891, pp. 400-26.

Monongahela. Detailed description with historical sketch. By Col. S. M. Wickersham before the Engrs. Soc. West. Pa. *Eng. News*, May 26, 1883, pp. 243-4.

Bridges, Suspension, continued.

Niagara.

The reinforcement of the anchorage and renewal of the suspended superstructure of the Niagara Railroad Suspension Bridge. By L. L. Buck. An elaborate paper of 34 pp. fully illustrated, describing a very important work. *Trans. A. S.C. E.*. Vol. X., (1881), p. 195.

Replacing Towers of. By L. L. Buck, before the American Society of Civil Engineers. Gives details of the work of replacing the stone towers of the Niagara suspension bridge with iron towers. *Trans. A. S. C. E.*, Vol, XVII. (Oct., 1887), pp. 204-212. Lon. *Engineer*, Dec. 9, 1887; Lon. *Eng.*, Dec. 9, 1887; abstracted *Proc. Inst. C. E.*, Vol. XCIII., pp. 510-512. *R. R. Gaz.*, Nov. 4, 1887, *Eng. News*, Dec, 10, 1887.

North River, Proposed.

By G. Lindenthal. Gives brief description of the proposed bridge, also gives a full page plate comparing the bridge with four of the greatest bridges in the world. *Eng. News*, Jan. 14, 1888, and *Eng. & Build. Rec.*, Jan. 14, 1888.

By Gustav Lindenthal, before the American Society of Civil Engineers. Gives very full details of the proposed bridge over Hudson River, at New York. Proposed dimensions are: River span, 2,850 feet; two shore spans, 1,800 feet; width, 68 feet, with six railroad tracks; height above water, 145 feet. Abstracted in *Eng. News*, Jan. 28, *et seq.*, 1888.

Pittsburgh, Repairing the Cables of. By F. Collingwood, M. I. C. E. A detailed account of the cause and extent of the rusting of the wires, and the methods adopted to repair them. *Proc. Inst. C. E.*, 1884, Vol. LXXXVI. *Eng. News*, Aug, 2, 1884.

Point Bridge, Pittsburg. Description and account of test. *Eng. News*, Apr. 14, 1877, pp. 89-91.

Replacing the cable by links on the Albert Bridge, London, the cable having rusted until the bridge is considered unsafe. Cuts showing the design; also four other systems. Lon. *Engineer*, Dec. 4, 1885.

Rope Bridges and Their Military Applications. Brief article discussing the best form of military bridge and illustrating one form of rope bridge. From *Le Genie Civil*. *Sci. Am. Sup.*, No. 824, Oct. 17, 1891, pp. 13163-4.

St. Ilpize and at Lamothe. By M. Nicou. *Annales des P. & C.*, 1885, Oct., pp. 660-683.

Theory of Modern American. By Prof. C. Clericette. Gives the mathematical theory. *Van Nos. Eng. Mag.*, May, Vol. XXIII., p. 111.

Vishwamitri River. Short description and abstract from specifications of a chain suspension bridge of 190 feet span, with two large plates showing elevation and details. *Ind. Eng.*, Dec. 10, 1887.

See *Bridge Accidents. Cables.*

Bridge Trestle.

Approaches to Arthur Kill. Description and detail illustrations of the trestle approaches. The approaches consist of about 6,600 feet of framed trestles and some 3,000 feet of pile trestle. *R. R. Gaz.*, July 26, 1889. Vol. XXI. p. 489.

Cluster Bent. By J. A. Hanlon. Gives details of a high trestle near Flushing, O., constructed on the cluster bent plan; shows plan and cross-sections. *Eng. News*, Dec. 31, 1887.

In Deep Water in Halifax Harbor. Water 80 ft. deep. Trestle weighed down by rock. Fully illustrated. *R. R. Gaz.*, April 9, 1886.

High Trestles of the Esquimalt & Nanimo Raliway. On 10 degree curve. Drawing of a center bent, 152 ft. high, with details. *R. R. Gaz.*, Feb. 6, 1891, p. 89.

Iron Joint Plates in. Gives detailed drawings showing the use of iron plates in stead of tenons, etc., as used in the construction of a trestle on the N. Y. L. E. & W. R. R. *Eng. News*, Nov. 5, 1887.

Bridge Trestle, continued.

McCoy's Creek, Fla. Description of pile trestle for which piles 130 ft. long were driven. Method of driving described. *Eng News*, pp. 133-4.

Novel Form. Brief description, with plan, elevation, and cross-section, of a novel form of trestle used on the L. & N. R. R. *Eng. News*, Oct. 29, 1887.

Pile and Trestle. By A. F. Robinson. Discusses the use of pile and trestle bridges, and gives design of the standard trestle of the Chicago, Burlington & Northern Railroad Company. *Eng. News*, April 7, 1888.

Pile and Trestle Bridges, Construction of. A paper read by A. Amos before the N. W. Track & Bridge Assoc. Abstract giving arrangement of details. *Ry. Rev.*, Oct. 4, 1890, p. 582.

Pile and Trestle Bridges. Description and drawings of standard pile and trestle bridges of various railroads. Condensed from W. C. Foster's forthcoming book on this subject. *R. R. Gaz.*, Oct. 10, 1890, p. 699, *et seq.*

Pile and Trestle Bridges on the Minneapolis & St. Louis Railway. Description and illustrations of a pile bridge and a high wooden trestle. By W. B. Hixon, Supt. Bridges and Bldgs. *R. R. Gaz.*, April 17, 1891, pp. 260-1.

Railway. By E. A. Hill. Treats of permanent and temporary trestle work, sustaining power of piles, review of railroad practice, etc. *Sec. An. Rep. Ill. Soc. Engrs. & Surv.*

Special Features in Wooden. Discusses the use of mortise and tenon-cap bolting, and bearings, etc. *Eng. News*, July 21, 1888.

Standard Plans. Give plans and details of the standard pile trestle in use on the Chicago, Burlington & Northern Railroad. *Eng. News*, June 9, 1888.

Standard Wooden. Gives plan, elevation, sections and bills of material for the standard wooden trestle of the Kansas City & Omaha R. R. *Eng. News*, Aug. 13, 1887.

Trestle Bridges and Modes of Maintaining them. By J. H. Curtis. An article on the erection of temporary structures. *Van Nos. Eng. Mag.*, Vol. XXVI., p. 383.

Wooden. Designs for Canadian Pacific Ry. Drawings of two standard trestles. *Eng. News*, May 2, 1891, pp. 418-9.

Wooden Trestle Bridge over the Huron River, at Ann Arbor, Mich., with plate. By Chas. E. Greene. *Report Mich. Assoc. Surv.*, 1881.

Bronze Casting. A lecture by George Simonds before the Society of Arts, London. Gives a detailed description of the several steps in producing a bronze statue or artistic model of any kind. Illustrated. *Sci. Am. Sup.*, March 20, 1886.

Bronzes.

Manganese. A paper read before the British Assoc. by P. M. Parsons. Gives characteristics, tensile strength, etc., of the different alloys. *Van Nos. Eng. Mag.*, Jan. 1884.

Strength of. A contribution to the subject from English experiments. *Trans. Liverpool Eng. Soc.*, Vol. V., p. 31.

Strength of. Prof. R. H. Thurston constructed a surface, showing in relief the relative strength of alloys of copper, zinc and tin; and Lieut. Pitman, U. S. A., drew a contour chart of this model. Cuts of both and a very clever editorial discussion given in *R. R. Gaz.*, Aug. 7, 1885.

Strongest of the. The method described of finding this combination; also strength shown graphically for all combinations. By Prof. Thurston. *Trans. A. S. C. E.*, Vol. X., (1881), p. 1; also *Van Nos. Eng. Mag.*, Vol. XXV., p 126; also supplemental paper in *Trans. A. S. C. E.*, Vol. X., p. 369.

See *Alloys*.

Buffer. See *Car Buffer*.

Buffer Stop. *Hydraulic.* Designed and described by A. A. Langley, Eng. Furnishes a constant resistance till train stops. Fully illustrated. Lon. *Eng.*, Feb. 19, 1886.

Building Construction.

Anchoring of Buildings. Present Defects and How Improved. A paper read before the National Association of Fire Engineers, Sept. 11, 1889, at Kansas City, Mo., by Mr. Henry A. Goetz, New Albany, Ind. *Sci. Am. Sup.*, Dec. 21, 1889, p. 11,645.

Chicago, Tall Buildings in. General description of design, methods of erection and framing. Details of the last illustrated. *R. R. Gaz.*, Oct. 30, 1891, pp. 759-62.

Chicago Construction, or Tall Buildings on a Compressible Soil. Paper by W. L. B. Jenney, before the Am. Inst. Arch., giving general design, methods of founding, framing, etc. Illustrated. *Eng. Record*, Nov. 14, 1891, pp. 388-90.

In Earthquake Countries. A valuable paper on this subject by John Milne, read before the Inst. C. E., giving the precautions and the peculiar methods of construction adopted. Condensed and printed in *Eng. News*, Jan. 18, 1891, pp. 33-4.

Flooring. Brief description of some German experiments on double flooring, with and without asbestos paper between. *Am. Arch.*, No. 820, Sept. 12, 1891 p. 157.

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And Sewerage of Hyde Park, Ill. Report upon. By Benezette Williams and John A. Cole, Civ. Engrs., Chicago. A 60-page pamphlet, with large map. The report based on a careful topographical survey. The project involves many new features. Apply to the authors.

A Water Supply of Chicago. See *Water Supply.*

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Earthwork, continued.

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